

AR36





Operating in the Arctic

Imperial Oil has been working in this
region since it staked its first claim in 1914

In Inuvik, N.W.T. there is a taxi driver – a *taxi* driver, of all people – who won't accept tips. If you ask him why, he will give you a look and say: 'Do you accept tips in your work?' In a way that cabbie personifies the North: proud, independent, hard and immensely admirable. The region is also a paradox: tough, yet delicate; a land where man can barely survive, but where man is the greatest threat to the land's survival. The Arctic is North America's last frontier and the movement to open it is in full flood.

And as activity there increases, interest in the region quickens. An area that was once the exclusive preserve of Indians and Eskimos, Mounties, missionaries, mariners, and the ubiquitous Hudson's Bay Company has suddenly caught the imagination of southern Canadians. Areas once unimaginably remote are on regularly scheduled air routes. Any day but Sunday you can fly from Edmonton to Inuvik, a town only 68 miles from the Arctic Ocean, in as little as 2½ hours. The distance is 1,200 miles, and when you land you are farther west than Vancouver Island. Inuvik follows Edmonton time, and the western displacement has an odd effect – your watch says noon but your eye tells you it's only 11 a.m.; in mid-February the sun rises at 10:30 and sets at a little after six.

In the summer, of course, it doesn't set at all, and local people display an amused tolerance of the

tourists, who can be identified by their habit of taking color photographs at midnight. But the local people are up and about, too, at that hour. People say they stay up later in summer, often surprised to find themselves still wide awake at 2 a.m. But in the winter the reverse happens, and residents begin yawning around 7:30 and toddle off to bed at nine.

And everybody's busy. Al Workman, superintendent of Imperial's refinery at Norman Wells, 90 miles south of the Arctic Circle on the east bank of the Mackenzie River, loaded himself up with cartons of books he had always meant to read when he learned he was posted to Norman Wells last July. 'I haven't opened even one,' he confessed in February. 'I haven't had a minute to myself since I arrived.'

That's hardly surprising. The refinery at Norman Wells is the only one in the Northwest Territories, and it supplies fuel for the operations in the North, working year-round in all the extremes of Arctic weather.

At one time, the Imperial refinery and Norman Wells were the same thing, and the only way you could stay there was as a guest of Imperial Oil. But in 1942 the federal government put in a wartime airport (the airstrip belonged to Imperial before that), and now there are a number of enterprises, including a hotel, that have increased the winter



Two lard pails tested the specific gravity of Norman Wells oil 50 years ago; one held water, the other oil, filled with a soup-can dipper

population to around 300. But the bank, the post office, the recreation hall, the school and the hospital are still on Imperial property.

Norman Wells takes its name from Fort Norman, 53 miles up the Mackenzie River, and from the oil wells that Imperial discovered there on Aug. 23, 1920. The men who drilled it under the direction of geologist Ted Link – Ed Wilson, Sam Byers, Jim Hyslop, Emery Dubuc, Gabriel Chatvaire and Joe Lanouette – took two months just to get there from Edmonton, the last leg on a wood-fired river steamer that served ‘nothing but beans and sowbelly.’ Jim Hyslop said the boat ‘was packed with trappers, traders, animals and equipment. There was enough cigar smoke, sweat and cussing to start another war.’

But they arrived at the site of the claims too late to do any drilling, and spent their time building cabins against the coming winter and hauling their equipment up the river’s steep banks to the drilling site. Their motive power was an ox, the only one in the Northwest Territories.

Why was an Imperial drilling crew looking for oil in such a remote location half a century ago?

Because of the need. In 1920 Canada produced only 196,000 barrels of oil, but it imported 8,312,000 barrels. Imperial’s position was stated in the Imperial Oil Review of February, 1921, in these words: ‘. . . if the wheels of industry were to continue to revolve there must be more oil . . . and a native supply was of the utmost importance.’ They had found the oil all right, and when the discovery well came in it was described as ‘the largest producing oil well in Canada.’ Its flow rate was estimated at 100 barrels per day in 1922, but alas the reserves were not enough to justify a pipe line to markets in the south, and the demand for fuels in the Territories was too small to keep the field producing. The wells were shut in and a small refinery – it was hardly more than a boiler – was closed in 1925.

It stayed closed for seven years, until the discovery of gold at Great Bear Lake in 1932 created a demand for fuels in the region. Imperial sent a crew to Norman Wells under the direction of Ronald MacKinnon to put the refinery into operation that summer. They got the operation going again on July 14, 1932, and by September 22 the field had produced 1,900 barrels of crude oil, enough for

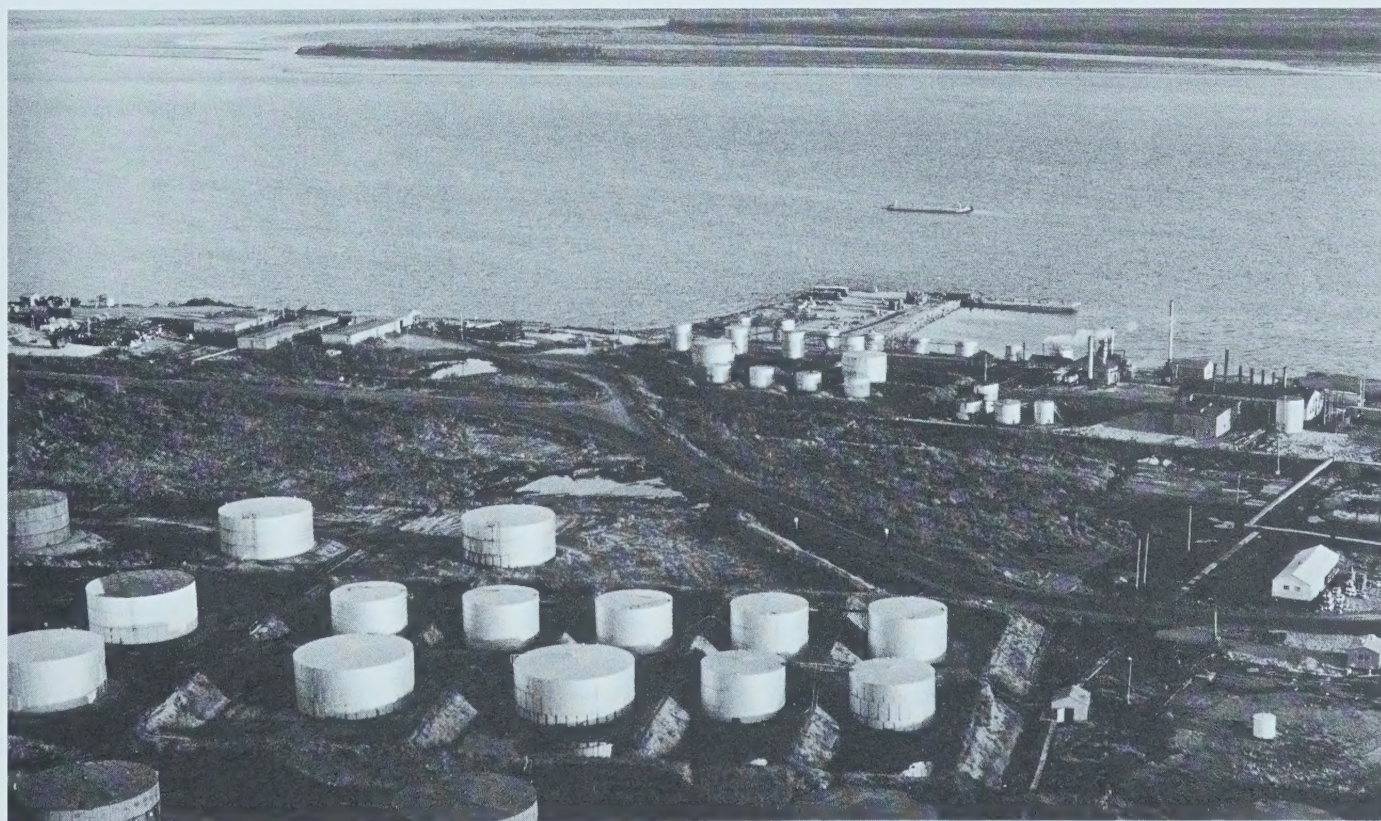
10,000 gallons of gasoline and 10,000 gallons of fuel oil for the mines at Echo Bay, 350 miles away. Imperial also donated 1,800 gallons of fuel oil to the Anglican hospital at Aklavik.

The refinery operated only in the summer, and transportation to Great Bear Lake was complicated by a portage around the rapids on Bear River. The portage was eliminated in 1937 when a pipe line 8½ miles long was built around the rapids. It is still in operation. By 1939 the refinery's capacity was up to 840 barrels a day, and that year it manufactured 85,000 gallons of gasoline and 10,000 gallons of fuel oil. Such amounts are insignificant today, but in 1939 they were vital. 'The production,' Bishop A. L. Fleming said then, 'has meant for us the efficient operation of our hospital at Aklavik, and for the whole area comparatively low-cost transportation by boat and plane.'

When the Japanese entered the second World War in 1941, Norman Wells suddenly assumed strategic importance as a safe source of petroleum for the armies and navies in the northern Pacific. A plan was formulated to increase the production of the Norman Wells field and build a pipe line 600 miles to Whitehorse, where a refinery would be built to refine the crude. The only trouble was that

nobody knew how much oil was in the Norman Wells field. Nevertheless, the plan went ahead. The pipe line was built in 20 months and four days at a cost of \$31 million. And by January, 1943, Imperial had drilled enough wells to meet the military's requirements of 3,000 barrels per day. The field provided almost a million barrels of oil to the pipe line for delivery to Whitehorse before the line was closed in 1945. When those hectic days were over the refinery at Whitehorse was sold to Imperial, dismantled and shipped to Edmonton where it was rebuilt to process the crude from the field Imperial discovered at Leduc in 1947. Production was cut back at Norman Wells, but the refinery there continued to provide products over an area of more than a million square miles, from Waterways in Alberta to Aklavik in the Mackenzie delta, and as far east as Bathurst Inlet.

Today Imperial is drilling in the Arctic again, and the company faces the same dilemma Norman Wells faced half a century ago: any discovery must be of amounts greater than any yet made in Canada. Based on certain assumptions, for instance, Imperial has estimated that the required threshold reserve in the Beaufort Basin to give a minimum return on investment is two billion bar-



Imperial's refinery and storage tanks at Norman Wells, on the east bank of the Mackenzie River, 90 miles south of the Arctic Circle

rels of recoverable oil. In the case of gas the threshold volumes would be about 15 trillion cubic feet.

But that's where the similarity ends. The men who drill for oil on Imperial's Arctic leases these days live in trailers with hot showers nearby. Their motive power is huge diesel-electric motors, and their living quarters are snug portable trailers arranged like a tiny village on the open tundra, grouped around a mess hall and wash house, and the closest they get to an ox is the beefsteak on their dinner plates.

Yet the region makes its demands on the men, the equipment, even the methods. Nobody goes into the Arctic unprepared, unless he is a fool, and Imperial prepares its employees for operation there with information on clothing they will require, the precautions they should take, especially on occasions when they must exert themselves – in the severe winter of the Arctic, perspiration can lead to frostbite and freezing.

Most Arctic precautions refer to the winter, for it is then that the region is most active. The land that is covered with soft, wet moss in summer freezes hard from October to May, although overland travel becomes possible only after mid-January when the ice on the rivers is thick enough for heavy machinery.

Not easy, but possible. For in the winter, roads can be built of snow over the tundra plains, and equipment can move. But the snow roads must be built with care, for if the film of vegetation that covers the permafrost is disturbed, melting during the summer months can result. Permafrost is permanently frozen ground, and it can be mud, sand and gravel, or solid rock. Where it's mud it must be kept frozen; if it melts, the water in it runs off and the soil that is left 'slumps', exposing more frozen mud that, in its turn, melts and slumps. The more frozen water there is in the mud, the greater the slumping. Dry gravels and rock, of course, don't slump. To keep the permafrost frozen, the layer of vegetation on its surface must remain intact – these tough little plants shield the ground from the summer sun so that melting seldom penetrates more than a few inches. When a snow road is built in winter, machinery operators must be careful not to scrape away the plant covering lying dormant under the snow, and Imperial operators are required to use a 'high-blading' technique that skims above the vegetation.

Why can't you just run over the snow with your vehicles? The surface of the tundra is not flat – in some areas it is composed of a series of hummocks three or four feet across, separated by cracks 18 inches deep. Driving a vehicle over those hummocks – even a tracked vehicle moving very slowly – is an experience in lurching and staggering that nobody wants to have twice. A snow road not only protects the vegetation; it fills in the cracks and makes travel possible.

There are vehicles that might be able to travel over the winter tundra without disturbing the vegetation, even where there isn't a road, and Imperial ran one last winter as a test. It is a huge tracked vehicle with yard-wide treads that exert a ground pressure of only four pounds. One of the experiments Imperial carried out last winter was designed to discover the effects this vehicle and a truck with big, soft tires would have on the tundra, as compared to the operation of trucks over a conventional snow road. The light-footed tracked vehicle ran all winter on a length of tundra at one side of the snow road, the big-tired truck along the other side, and conventional trucks and tracked vehicles along the snow road itself. This summer a botanist will be engaged to assess the effects of all three.

Trained specialists like the botanist are a fairly common species in the Arctic today and their studies form the basis for operating practices there. For example, the Canadian Wildlife Service sent a specialist to the Arctic last year to spend the summer at Imperial's drilling site at Taglu on Richards Island in order to study what effect summer drilling activity has on bird life. Imperial paid the investigator's salary and provided him with board and lodging, but he was hired by the wildlife service and his report will be made to it. Other studies have given rise to regulations governing the movement of aircraft between May 15 and Sept. 1, when the birds are nesting and raising young. Aircraft cannot fly below 1,500 feet except in emergencies, and they are required to keep above 2,000 feet over the Kendall Island bird sanctuary in the Mackenzie delta.

Imperial is investigating the possibility of building artificial islands in order to drill offshore in the shallow Beaufort Sea, and one of the company's actions has been to retain a consultant to study the movements of the beluga, the Arctic white whale that provides both food and sport for some Arctic people. But before a single load of fill is carried to the island sites, the impact of the proposal will have



Imperial's Taglu G-33 well, 70 miles east of Inuvik. Tests showed wells in this field will be capable of gas production at high rates



A seismic party snakes among the islands of the Mackenzie delta. These trains follow the river when the ice is thick enough to support them

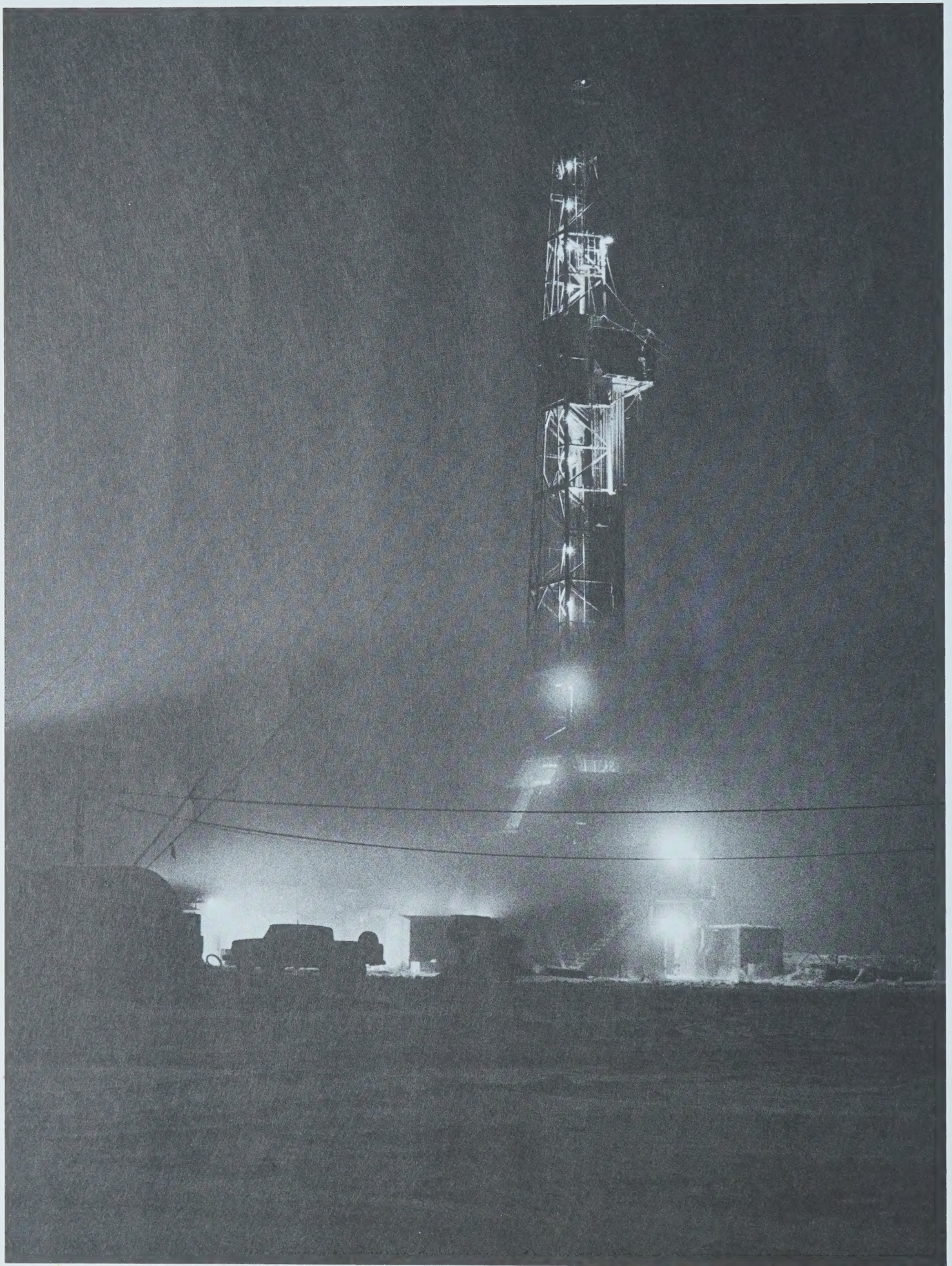


been exhaustively studied. And not only for environmental reasons; building an island in the Beaufort Sea and then drilling a well from it is such an enormously expensive thing to do that you simply cannot afford to make a mistake. In the Arctic, Imperial's Board Chairman, W. O. Twaits has pointed out, protecting the environment is simply good business practise – you just can't operate any other way.

The oil industry is sponsoring tests, studies, surveys, samplings, and reconnaissance in the Arctic budgeted at more than \$2 million. In fact, just coordinating all this research costs \$37,500 a year. Imperial tries to predict the impact its operation will have, and is experimenting with 'potential impact' records that list 32 different company activities and charts them against 38 environmental factors. It takes time and study to fill in the chart, but when it's done it is hoped that you can tell in minutes what degree of impact any one of those activities will have on any of the environmental factors.

Forward planning is an essential part of Arctic operations. Imperial has to make up its mind by February about some things it will be doing in the Arctic the following winter, or it can't count on getting the supplies it will need. Large casing 20 inches in diameter, for instance, must be ordered in March if you want to have it on hand for drilling in November. And that's only one item in the 20,000 tons of equipment and material that Imperial sends into the Arctic in any one year. The company spends \$2 million on transportation costs alone. And the food! Imperial served 146,000 meals at its Arctic camps last year. The grocery bill is \$42,000 a month. The total cost of Imperial's exploratory operations in the Northwest Territories last year came to over \$20 million.

Most of the supplies that go into the Arctic float there on barges pushed 1,122 miles down the Mackenzie River to Tununuk and Tuktoyaktuk from the end of the railroad at Hay River on Great Slave Lake. Not all the freight into the Arctic goes down the Mackenzie though. Inuvik airport receives more than a thousand tons of air freight a year, flown mainly from Edmonton at a cost of \$540 a ton. Even at that price, air freight is sometimes cheaper than barging, considering that the barges can usually count on running only between mid-June and mid-September. Last winter, for example, Imperial flew some well-logging and testing equipment into the Arctic because it was cheaper to pay the extra freight than to pay for equipment



The first oil found in Canada's Arctic was discovered by this Imperial well at Atkinson Point on the Tuktoyaktuk Peninsula on Jan. 14, 1970

that would have to remain idle until it was needed. The costs of Arctic exploration being what they are, such economies cannot be ignored.

No matter what economies are effected, the development of northern oil and gas resources promises to be enormously expensive. The oil industry expects its capital expenditures to reach \$5-6 billion in the Beaufort Basin by 1980 to find and develop the hydrocarbons there and to build pipe lines to move them to Edmonton. Some companies will discover large reserves, others will discover reserves in amounts that will allow only marginal returns, and a great many more will make no profit at all. Despite the risk, the search goes on, with some indicated successes. Imperial has drilled a second successful oil well and three gas wells since the strike at Atkinson Point on Jan. 14, 1970. A well jointly owned by Gulf and Mobil found natural gas and some condensate at a site 45 miles north of Inuvik on Feb. 23 and Panarctic Oils Ltd. made an oil discovery at Fosheim Peninsula on Ellesmere Island last Feb. 24. Gas has also been discovered in the Arctic Islands, and although these discoveries do not yet justify the investment that will be needed to produce the oil and gas and transport them to markets, both the oil industry and the Canadian government are confident that it is only a matter of time until sufficient reserves *are* discovered.

In the meantime, research work goes forward on the transportation systems that will be needed. Imperial is a participating company in Mackenzie Valley Pipe Line Research Limited, a company whose purpose is to study the feasibility of building a pipe line from the Arctic to Edmonton, developing methods that will permit its construction and operation with a minimum disturbance to the land, the animals and the plants. The research is well advanced, and none of the problems is beyond solution. In fact, the general location of the line – a route that follows the Mackenzie Valley mainly – is generally accepted. And the ground rules are these: the pipe line must not destroy existing social patterns in the North; its benefits should be shared with northern residents, particularly in employment during its construction; it must not unduly damage the land through which it passes, nor disrupt the life patterns of the native animals. Certain sections can be built only at certain times of the year, when construction will not disturb wildfowl

in their migrations or nesting grounds. Even archaeology is taken into account: there is evidence that the first men to enter this hemisphere came from Asia, across the Bering Strait, and signs of their passage may be found along the pipe line route. Wherever such signs are found, the sites will be avoided or investigated before the line goes through. In fact, without the pipe line construction, such archaeological sites probably would not be investigated at all. The cost of this archaeological work to the pipe line is expected to reach \$1.5 million.

For an oil company, such problems are accepted as part of the day's work. But there are others that lie beyond a business organization's competence: namely, the political problems. The rights of native people, for example, cannot be determined by businessmen. Like anybody else, businessmen hold views on the best solutions to political problems, but nobody expects them to supply all the answers. When the rights of native people have been determined, the companies operating in the area will respect them.

In the meantime, Imperial's policy in the Arctic is to hire native people wherever it is feasible, and to participate in programs aimed at training local people in the skills needed. But enough good men and women are hard to find, even in Edmonton where the population is 458,000 and the oil business is of long standing. They are that much harder to find in the Arctic, where the population of the Yukon and Northwest Territories combined comes to only 53,000 and oil-drilling is something new. The matter is complicated by different cultural attitudes to work and wages, and even by such a thing as airline schedules. For example, Imperial flies its supply planes into the Arctic on a regular schedule, and in consequence it has developed a work pattern that brings a man out of the Arctic for 10 days after he has done 18 days' work. The plane flies to Edmonton, since that is where the supplies are, and the drillers who live in the south can go with it. But if the roughneck's home is in Fort McPherson, say, or Paulatuk, what do you do? What if there are a dozen men, from a dozen different Arctic communities?

Such problems are not insoluble. In fact, you could hardly call them 'problems' at all, and their solutions will arise in response to the operation, the way water running downhill finds its path around obstacles. Experience teaches you how best to operate in an area like the Arctic, and the reputation of oil companies there is a good one. A

federal government study group toured the Arctic in 1970 and reported: 'It is fortunate that there are companies operating in the area having responsible management and the resources for developing the technology necessary to cope with the special problems of exploration and development in this difficult and sensitive environment.'

An example from Imperial's operations indicates how Arctic solutions can often be found to Arctic problems. The problem is garbage generated by seismic crews which stay in one place for only three or four days before moving on. Yet the wash wastes, toilet wastes, kitchen wastes, broken-down equipment, and discarded packaging cannot simply be left behind. The organic wastes from kitchen sinks and toilets are not a serious concern – their effect on the tundra is about the same as caribou droppings – but Imperial discharges them at least 300 feet from any stream in accordance with federal government regulations.

Solid wastes are something else, and in the climate of the Arctic they disintegrate so slowly that they are virtually everlasting. Nuts and bolts stockpiled in boxes when the Canol pipe line from Norman Wells to Whitehorse was closed down in 1945 are still in such good condition after 27 years that you can unscrew the nuts with your fingers. But old soup cans, bits of wood, bottles, papers and other litter don't decompose much faster than nuts and bolts, and remain a virtually permanent blot on the tundra. To eliminate this nuisance, Imperial crews carry a travelling incinerator with them that consumes everything that will burn, and chars everything that won't. The ash that's left, including food cans and bottles, is buried in holes a foot wide drilled 15 feet into the ground, made by the seismic shot-hole drills. The holes are filled to within two feet of the top, then backfilled with soil. They freeze solid, and the two feet of backfill keeps them frozen just like the surrounding permafrost. Stuff that can't be burned or buried is sent to an Imperial base camp at Tuktoyaktuk or Tununuk.

Since seismic parties stay such a short time in any one location, their effect on the countryside is very small. A drilling camp, however, contains about 30 people, and it stays in one place between three and six months. To deal with the sewage generated by such a settlement, pits must be dynamited out of the permafrost. The pits receive all wash, kitchen and toilet wastes, as well as waste drilling liquids. It all freezes, of course, and before the camp moves the pit is covered with the soil and vegetation removed originally. Combustible wastes are inciner-

ated and the ash and charred material buried in the sewage pit, and non-combustible junk returned to the central dumps.

In the biggest camp of all – Imperial's base camp at Tuktoyaktuk – sewage is disposed of by means of a primary-treatment lagoon approved by the regional engineer of the federal government.

Some actions to cope with northern conditions arise from simple common sense and accurate observation. At Norman Wells, for example, a road must be cleared across the jagged blocks of tumbled ice on the Mackenzie River in winter so that operators can reach the producing wells on the islands and maintain the water-injection batteries that stimulate oil recovery from the Norman Wells fields. But you don't just send a bulldozer out on that ice, even though it is five feet thick in places. There are other places where the ice never gets more than a few inches thick, places where natural gas seeping from the formations underground bubbles up from the river bed and inhibits ice formation. If a tractor runs over such a spot, it goes through, and the water may be 40 feet deep. People who have lived in the settlement for a number of years know roughly where the seeps come to the surface, but even then, they go slowly, poking the ice with probes to test its strength. One of Imperial's most knowledgeable employees at Norman Wells is probably Eddie Hodgson who, as a utility man, is responsible for the producing wells and water injection pumps in the islands. Hodgson was born on the north shore of Great Slave Lake and went to school at Fort Providence, where he learned a little French.

Hodgson has been an employee of Imperial for 21 years, and he expects the relationship to continue. He's a member of the settlement council and believes Norman Wells should be the capital of the Territories. His ambition is to get a little place up in the Franklin Mountains just behind Norman Wells to the north. 'My daughter wants a horse, and maybe we could keep one up in the mountains,' he said. In the meantime, he has a house in Norman Wells, a snowmobile for the winter forests, and plans to grow potatoes on Bear Island this coming summer. You can't grow root crops very well on the mainland, he explained, because of the permafrost, but there is no permafrost on the island.

And when he's not tending to producing wells or growing potatoes, Hodgson hunts. One day last



Puffing along a snow road across Richard's Island near the mouth of the Mackenzie River, a seismic party probes the area's geology



The cold that locks the soggy plains and looping streams of the Mackenzie delta in ice opens the region to its season of greatest activity

winter he got up early to set a trap for a wolverine whose tracks he had noticed. He had the creature by noon – he figures its pelt is worth \$200 – and that evening he went out with his 12-year-old son and bagged two moose.

And when he's not working and not hunting, he visits. 'Sometimes,' Hodgson said, 'it seems like everybody is my aunt or my cousin.' They may very well be: Hodgson's father was married twice, and had 12 children; his mother was married twice, also, and bore another eight. So Hodgson comes from a family of 20 half-brothers and sisters.

For Hodgson, life at Norman Wells is just about what he wants it to be – a quiet community near to the woods where people are close to each other and doors stand unlocked. Hodgson says there are no drugs, and no gangs. There is also no television and radio reception is unreliable, but there is a rich social life revolving around the community hall in Norman Wells where the movies are shown and dances are held. There is a mission church – Catholic on one side of the building, Protestant on the other – a post office, a store, the refinery hospital.

For refinery superintendent Al Workman all these things make him smile at the notion that it's necessary to schedule a six-day work week at Norman Wells to fill in the time. He's postmaster, hotel-keeper (Imperial still maintains accommodation for visiting dignitaries), justice of the peace, social arbiter. He also has to keep the refinery and its steam plant operating, even if it means working half the night in 45-below temperatures and freezing his nose, as he did last February when one of the oil lines froze. And then turn into a gracious host, presiding with his wife at a candlelight-and-wine dinner party. Or turn into the Good Samaritan and send one of the hospital's two nurses to accompany a sick missionary to hospital in Edmonton, as he did last winter.

But being a Good Samaritan is virtually part of the job at Norman Wells. The Arctic is still an untamed wilderness, despite its telephones and movies and scheduled airlines; people lose their way, and stand in danger of losing their lives as well. It happened that way in 1948 when three men left Johnson's Crossing in the Yukon, intending to drive their Jeep along the 600-mile Canol road to Norman Wells. They expected to do the trip in four days. Half-way there they picked up a trapper

and his wife, and bowled along to the Twitya River, 131 miles from Norman Wells. But they lost the Jeep crossing the river, and had to start walking. They walked 40 miles despite the fact that one of the men had a bad heart and another a collapsed lung that needed medical attention every 12 days. Ninety miles from Norman Wells the two ailing men had to stop. The trapper and his wife stayed with them while the third man left to walk the remaining 90 miles to Norman Wells. On Aug. 16, two weeks after the party had left Johnson's Crossing, the refinery at Norman Wells received a wire asking if the men had arrived, and this was the first the refinery heard of them. The next day RCMP constable Roy Wilson and a watchman from Camp Canol set out along the trail, and at Mile 9 they found the man who had been walking out. He was exhausted, and they brought him back to the refinery hospital. The next day an RCAF plane flew back along the trail and dropped supplies to the party still in the bush, by this time camped at Keele River.

A rescue party had already set out from Norman Wells: Angus Hooker, Charles McNeil, Neil Sherwood, Bjarne Gravdahl and Constable Wilson. For four days they labored along the trail, at one point roped together and wading, swimming and stumbling for six miles through the tumbled boulders that cover the floor of Dodo Canyon. They found the party on Aug. 20, but the two sick men were in no shape to travel. They would have to be carried out.

Undaunted, the men from the refinery set out to make a conveyance. With no more tools than a pair of pliers and a six-inch wrench they went to work on a broken-down tractor left at the site when the pipe line was abandoned three years earlier. The machine's engine had a broken connecting rod, and the men repaired it by pulling out the damaged piston and sealing the hole with bits of tire and plywood. They had to repair some controls and fix other bits and pieces, but they got it going and, with the exhausted travellers on a makeshift sled behind, started for home. They reached the Wells at midnight on Aug. 22, and everybody survived.

People still try to walk the Canol trail in summer, starting from Norman Wells, and they never make it. Eddie Hodgson says they're gone for about two weeks, then come back the way they went.

'Funny thing, though,' he says. 'If they went just a little farther, they'd be over the worst of it. The rest is easy.'





Animals of the Arctic

To thrive in the Arctic's extreme climate, the birds and the beasts have evolved in special ways

The animals of the Arctic live in a region of extremes. It's bitter cold and dark in winter ; briefly hot and bright in summer when the sun shines day and night. There is so little precipitation that the area is classed as a desert. Yet poor drainage and slow evaporation leave so much water on the ground in summer that the tundra plains are virtually awash.

At first glance the winter Arctic looks lifeless, but even on the coldest, darkest days there are creatures moving, taking part in an incredibly complicated web of life that is exquisitely adapted to this exuberant land. Some stay and cope with the extremes in ingenious ways ; some have evolved into creatures so dependent on the midnight sun that when autumn comes to the Arctic, they migrate all the way to the Antarctic to find constant daylight when the North is in constant darkness.

One that stays is the caribou, the reindeer of fact and legend, the quarry of hunters since men first began painting pictures on cave walls. Caribou number perhaps 350,000 in Canada, up from an all-time low of 200,000 in 1958. Their range can support about two million.

Caribou have to move to survive in the Arctic. The Barren Ground caribou spend their winters in the spruce-forested taiga south of the tree line, using their big shovel-shaped hooves to paw away the soft snow down to the 'reindeer moss' beneath. Ordinary livestock would starve on the meager two to five per cent protein in this lichen but the caribou thrive on it.

As lengthening daylight foretells the approach of spring, the small bands of caribou gather in larger and larger herds. They eat more voraciously and their metabolic balance improves. The animals get restless. Spring warmth begins to melt the snow by day while the cold nights freeze it into a crust that hampers the animals' efforts to uncover lichens. Gradually, the herds start drifting north, seeking softer snow and following ancestral urges. The does go first, heading for their fawning grounds on the tundra ; the bucks follow a few weeks later. The restless drift soon becomes a purposeful march as the caribou follow the easiest paths along watersheds or head straight across frozen lakes,

always heading north despite fog or heavy overcast.

The does reach the fawning grounds in May, in time to drop their awkward-looking fawns as the bucks begin arriving. The next five to six months they spend grazing the tundra meadows, all the while seeking windy heights to evade the maddening irritation of mosquitoes and the warble fly, a parasite whose larvae burrow under the caribou's skin on their backs before emerging to pupate into adults the following summer. October finds the caribou back at the tree line for the brief mating season before another winter deep in the boreal forest. In their wanderings they will have covered perhaps a thousand miles and investigated every object in their path from a muskox skull to a parked helicopter, for they are as curious as cows.

Robert Belous

The polar bear is the epitome of the Arctic, a powerful beast that stalks the region all year, oblivious to cold under a thick pelt of waterproof fur so buoyant that the bear is as much at home in the freezing sea as it is on the frozen land. Rough leathery pads on its paws and stiff bristles between its toes give it sure footing on ice, and huge paws make it a strong swimmer. Its larder is the sea and it preys on seals, young walrus and fish, although it will eat almost anything – dead whales, birds' eggs, berries, even the garbage outside settlements. Its weight may reach three-quarters of a ton, although it weighs little more than a pound when it's born in a snow den in winter while the mother is in a state of semi-hibernation. Usually two cubs are born, and the mother bears a litter only every second year.





Fat, bleary-eyed, wrinkled and toothy, the walrus may not be much to look at, but all those attributes help it to survive : the fat insulates its body in the freezing ocean ; the eyes are adapted for underwater vision ; that hide is tough enough to blunt knives ; and those tusks pry shellfish from the ocean bed as deep as 200 feet. On this diet the adults may reach 3,000 blubbery pounds. The young don't develop tusks until their second year – until then they live on mother's milk. If a young walrus is orphaned during this period it must turn predator to survive. It spends the rest of its life preying on seals and other animals ; its body stays lean and its tusks grow long and sharp.

An Arctic hare (left) dozily suns in the shelter of a rock, conspicuous in a coat that stays white all year in the high Arctic islands ; farther south their fur turns brown in summer. About the size of a house cat, the Arctic hare is the smallest animal with fur thick enough to protect it against the Arctic winter cold ; smaller animals either hibernate or retreat to burrows under the snow. But the hare stays active, running on snowshoe feet whose wide-spread toes and stiff bristles hold the hare up where fox and lynx would flounder.

A harp seal of the eastern Arctic waters pops up for a look around the ice fields and a breath of air. Seal fur is little protection against the cold ocean water ; the seal depends instead on a layer of fat for insulation and a blood circulation system that conserves body heat. In winter Arctic seals must keep breathing holes open by gnawing the ice away – they usually stay under water only three or four minutes at a time, although they can hold a breath as long as 20 minutes if necessary. Harp seals are hunted for their fur ; as many as half a million have been taken in a year off Canada's east coasts.



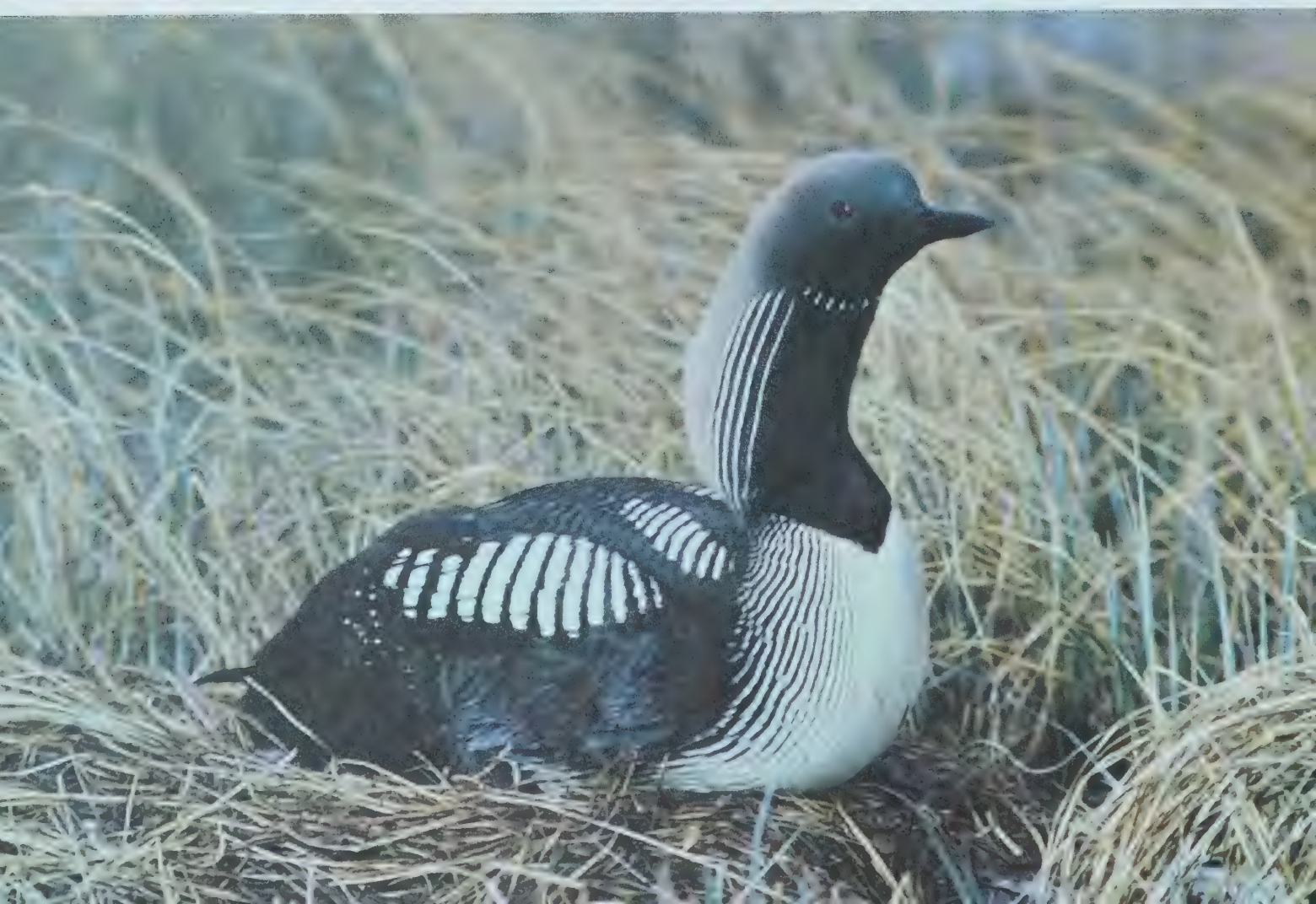




The Barren Ground grizzly, left, a solitary monster that may weigh as much as 800 pounds, prowls the summer tundra eating anything that happens to catch its eye – berries, shoots, lemmings, carrion, grubs, eggs and nestlings, even a caribou if it gets the chance. Its unpredictable moods can make it dangerous to man, but its dwindling numbers cry out for protection. In winter this bear creeps into a rocky den for long periods of torpid inactivity, but it doesn't really hibernate.

The snow goose comes in two distinct sizes : the lesser goose at four to six pounds, and the greater at six to 10. Otherwise, their appearance is identical. But the lesser goose is found throughout the Arctic, and flies south across the prairies and down the Mississippi valley ; the greater is found only in the eastern Arctic, and migrates across Ungava and the U.S. Atlantic coasts, with a stopover at Cap Tourmente, Que., each spring and fall. Both sizes spend the months from June through September in colonies on the low, flat tundra raising half a dozen goslings that can run and swim from the moment their fluffy yellow down dries after hatching in the grass- and down-lined scrape of a nest. The season is short – a hundred days from nesting to migratory flight – but the long days permit the geese to hatch their eggs, raise their young, and prepare them for the long flight south to their wintering grounds around the Gulf of Mexico or along the western coast of North America from southern British Columbia to California.





The smallest sea-bird of the Arctic is the dovekie (top left). Not much bigger than a man's fist, this tiny bird lives in the region all year round, laying its single egg on the bare rock of rookeries where the accumulated guano nourishes deep beds of brilliant green moss. Preyed on by fish, seals, gulls, falcons, foxes and man, it's an indispensable link in the food chain at sea.

The all-time champion traveller is the Arctic tern, a gull-like bird about the size of a pigeon, but no more like an average city hall pigeon than a whippet is like a bulldog. The Arctic tern nests across the Northwest Territories, laying its two or three eggs in a shallow scrape on the beaches, gravel bars, or tundra hummocks, and spends its winters as far south as the edges of Antarctica. In both places it enjoys 24-hour daylight ; it probably sees more sunlight than any other creature.

To spend so much time in the sun it must travel 24,000 miles a year, and the Arctic tern is superbly equipped for the voyage. Its wings are very long for their width, a shape that reduces drag ; and they are very large for a bird the tern's size — a crow's wings would have to be five times as large to achieve a comparable wing loading — and consequently the tern needs less energy to fly. Its bones, like those of all birds, are hollow ; its feathers conserve body heat ; its diet is rich in energy ; even its breathing is synchronized with its wing-beats.

How can it navigate over such long distances to find its nest each year ? The sun and the stars are known to offer the bird guidance, yet it navigates equally well in fog or heavy overcast, suggesting to some researchers that the Arctic tern is sensitive to terrestrial magnetism and perhaps other forces that the unaided senses of man can not detect at all.

The Arctic loon (bottom left) breeds all through the Arctic from Baffin Island to Alaska and south to James Bay. As winter nears the birds head for the Pacific, the eastern birds following the northern coast and around Alaska in a remarkable migration. The young birds don't return until the second summer ; where they spend the intervening summer is still a mystery.

Robert Belous





Photos: Jerome Knap

THE LAST RESORT

It was the howling of the huskies that woke me. The noise came from several directions as team answered team and all the dogs joined in until there were more than 200 of them in full chorus. It was a welcome sound. I had not heard the howl of a husky for several years; snowmobiles are making them extinct.

'Better enjoy it while you can,' I thought. 'In a few years, even here it will be gone.' I was at Colville Lake, a

settlement past the Arctic circle, about half way between Great Bear Lake and the Arctic Ocean on the fringe of the forested taiga where the stunted black spruce meet the great tundra barrens.

Colville Lake Lodge, the most northerly fishing lodge in the western Arctic, is right in the middle of an Indian village that grew around an Oblate mission established by Father Bernard Brown, a Roman Catholic missionary, in 1962. The mission attracted a few

Indian families from Fort Good Hope, and the village grew to 12 families consisting of about 75 people: big enough to support a store and to require a health clinic, but still small enough that all the men can run traplines in the surrounding taiga.

Shortly after Father Brown established his mission and health centre, a fur trader followed him and opened a store. When the fur trader died shortly after, the residents of Colville Lake



Once a church, then a mission, now a community meeting house, the tower-topped main building in Colville Lake overlooks the float plane dock and the ice house, set right into the permafrost. At the right is the health centre; a doctor visits during the summer

Canada's most northern fishing lodge is at Colville Lake. It's hard to reach, but the fishing's great

by Jerome Knap

organized a co-operative and hired George Barnaby, an Indian from Fort Good Hope, as its manager.

Father Brown and the villagers built the fishing lodge to provide a better income base for the community. During the fishing season, the young men serve as guides for the visiting anglers, and several women work in the kitchen or as chamber maids.

The villagers have also established a small but thriving souvenir trade. Some

of the skills of the village women include fine bead work on mitts and slippers of caribou hide lined and trimmed with muskrat fur, and their entire winter's output is often purchased by the first group of anglers that comes in the summer. Some of the older men also make toy canoes of dried lake trout skins stretched over a wooden frame, and letter openers from the shin bones of caribou.

The people of Colville Lake village

are the Hareskins of the Chipewyan nation. The neighboring tribes call them the Nelagootine—the people at the end of the earth—because they live close to the Eskimos whom they once regarded as something less than people.

The Hareskins make their living from the taiga. The Barren Ground caribou migrate into this area in winter providing the villagers with their main source of meat. Moose and woodland caribou are also occasionally shot, as

are black bear and even Barren Ground grizzly. Lake trout and whitefish are other staples, smoked or sun dried.

The dogs eat frozen fish, and 8,000 to 9,000 pounds of fish have to be netted in the fall to feed one team of sled dogs during the winter; a working husky needs five to six pounds of frozen fish per day. Huskies are indispensable for winter hunting and trapping, for the snowmobile has yet to penetrate this remote corner of northern Canada.

The Hareskins' main income comes from their traplines, and marten (the 'sable' of the fashion industry) is their chief quarry. The average family income is about \$3,500 a year—not much in a city like Edmonton, perhaps, but at Colville Lake there are no mortgage payments, no real estate taxes, and no bills at the corner butcher store.

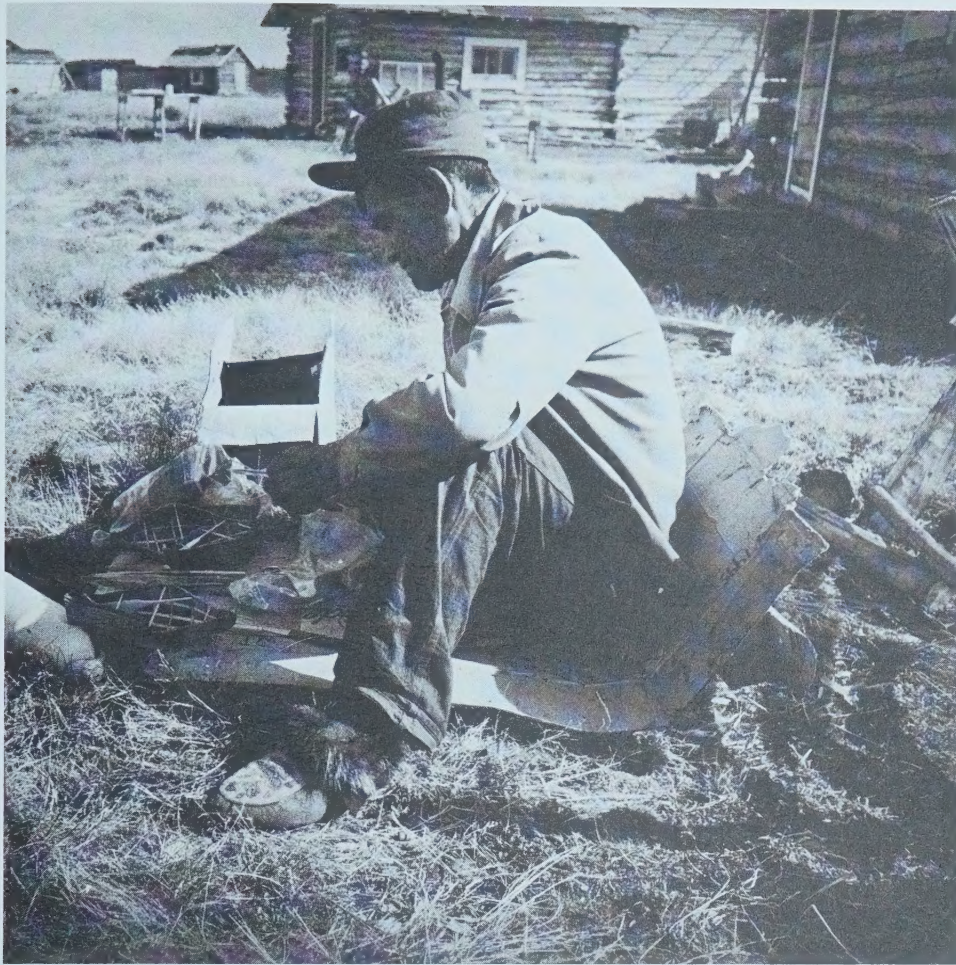
Yet the village of Colville Lake is more than just a picturesque settlement boasting a store, a health centre, a fishing lodge and a church. Colville Lake is, in reality, an experiment in living. During the past decade or two, Indians have been giving up the traditional life and moving to the forts along the MacKenzie to be closer to stores, churches and health centres. But the moves have produced problems—overcrowding and unemployment among them. With unemployment came relief cheques and the loss of dignity and independence. The question was—if these conveniences could be offered in the bush near the traplines, would the people stay or even return to where they could earn a living for themselves?

'Living on relief in Inuvik or Fort Good Hope is no good for anyone,' George Barnaby told me when I was buying some souvenirs at the co-op store. 'We must show the kids that life here can be good. And there are more jobs for trappers than for accountants in the north. Things may be different when the oil wells and mines are opened, but that's 10 and perhaps 20 years away. What good does it do for kids finishing school now?'

But the ideas of Bernard Brown and George Barnaby were not uppermost



In a boat he built himself, Philip Codzi pulls a whitefish for his table from a net set for lake trout, which he uses to feed his sled dogs



Souvenirs of Colville Lake: carved caribou bones and toy canoes of trout skin on spruce frames

The children of Colville Lake: the lodge may help them by diversifying the band's way of life



in my mind that morning when the dogs woke me with their howling. I was thinking about fish, and the light shining through the space between the curtains told me that the sun must be well above the horizon, although it was only 5:30 a.m. I got up and looked through the window. Colville Lake lay flat calm. I washed and dressed hastily, but I didn't shave. I was too eager to see if there were any big trout near the sandy shallows around the shore. Picking up my spinning rod, I walked out onto the aircraft dock.

My first three casts were unproductive, but on the fourth cast a fish hit my Dardevle spoon. I set the hooks but almost immediately I knew that the fish was a small one: a pound and a half, it turned out. During the next half-hour I probed the water around the bay. I caught several more lake trout, some of which were a little bigger than my first. When I was certain that no big fish lurked near the shore, I stopped fishing and strolled through the still-sleeping village. It was orderly and prosperous-looking. Some of the log cabins had a fresh coat of varnish. Only the husky dogs were awake, chained behind their owners' cabins, and they eyed me suspiciously. An almost-white pup gamboled out until it got within a few feet of me. Then it lost its courage and ran back to its mother.

Looking around I could see a few cabins with fish racks holding lake trout and whitefish split open to dry. Here and there nylon fish nets were draped loosely over poles. Traps of mixed sizes hung from cabin walls. At the far end of the village there was a baseball diamond and some swings for the children.

First to rise in the village to his morning task of lifting his nets was Philip Codzi. I went with him. The first lift was an old tattered net set for pike in a small weedy bay. It held about two dozen fish from 12 to 18 inches long—enough to feed his dogs. The second lift was out in the lake, set deep for lake trout and whitefish. The catch was fair—about a dozen lakera and a couple of whitefish destined for Philip's table.

It is the lake trout that brings anglers to Colville Lake, and I had spent several days enjoying a working holiday here. And though lake trout were our main quarry, we spent a little time casting for northern pike at the mouths of creeks flowing into the lake. It would



The new Catholic church was built of peeled spruce logs in 1966 by the village residents and topped by a steeple with a bell donated by some Iowa Mennonites. The church claims to be the highest log building in the Territories. The 'tepee' is for drying caribou skins

have been no trick in some places to catch a northern on every second cast, but the fish were not large, no more than six pounds. The water in the Arctic is just too cold for pike to grow as big as they do in waters farther south.

But in lakes farther south, lake trout seek deep cold water as the summer sun

warms the shallows. To catch these deep-water lake trout you need heavy tackle and metal lines. This offers little challenge to the angler and little chance to the fish. But the water in the lakes of the far north stays cold all summer, despite long hours of sunlight. Hence the lake trout—even the big fish in the

20 to 25-pound class—stay near the surface in Colville Lake where they can be caught on light tackle, providing maximum sport.

I don't know how many lakers I caught during my stay. I didn't keep count. But a party of six Toronto anglers who stayed at the lodge with me caught

more than 40 trout in about two hours.

We had also spent some time fishing for the queen of the Arctic streams—the Arctic grayling. Aside from a radical difference in landscape, this fishing is very like fishing the chalk streams of England where an angler has the opportunity to present a fly to an individual fish.

Like every fishing paradise, Colville Lake is remote; but it is not difficult to reach. There are daily flights from Edmonton to Norman Wells via Pacific Western Airlines. From Norman Wells, where Imperial Oil operates Canada's most northern oil refinery, one has to

charter the remaining 140 miles to Colville Lake. Northward Aviation is the only bush air service operating out of Norman Wells and will quote charter costs.

On the day before I left Colville Lake, Bernard Brown and I were lingering over a second cup of after-dinner coffee on the dining hall porch when a boat came slowly around the point. As it neared the lodge, I recognized its occupants—Pierre and Philip Codzi and their parents, Chief Beargrease and his wife.

'They are back early,' Bernard Brown said. 'They must have gotten one.'

As the boat came ashore, we could see several hundred pounds of meat on the floor. A small bull moose, I gathered, from its skull. It didn't mean much to me, but for the people of the village it was a sensation. There had been no red meat for two weeks. The kill meant that the meals during the next few days would be a welcome change from a diet of lake trout and whitefish.

I think that's what really characterizes Colville Lake: it's the kind of place where the basic things are most important, where the return of a successful hunter is still considered an occasion for rejoicing.

In the sandy shallows by the float plane dock, Bernard Brown makes repairs to his freighter canoe. The fishing lodge is at the right of the photograph, above the ice house, and the little building at the end of the point is the village co-operative store



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